EMI TERMINATING AND GROUNDING STRAIN RELIEF CLAMP ASSEMBLY

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Related U.S. Application Data

Continuation-in-part of application No. 09/432,248, filed on Nov. 2, 1999, now abandoned, which is a continuation-in-part of application No. 09/149,209, filed on Sep. 8, 1998, now Patent No. 6,116,955, which is a continuation-in-part of application No. 09/034,562, filed on Mar. 3, 1998, now Patent No. 5,146,204, which is a continuation-in-part of application No. 08/986,378, filed on Dec. 8, 1997, now Patent No. 5,989,065, which is a continuation-in-part of application No. 08/687,082, filed on Jul. 23, 1996, now abandoned, which is a continuation-in-part of application No. 08/521,776, filed on Aug. 31, 1995, now abandoned, which is a continuation-in-part of application No. 08/435,122, filed on May 5, 1995, now abandoned.

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References Cited

U.S. PATENT DOCUMENTS

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ABSTRACT

An EMI terminating and grounding strain release clamp assembly or “backshell” is provided having male and female component members and coupling intermediate members constructed of conductive metals. Upon coupling of the female and male component members a split metallic ring is compressed and envelopes a termination platform with electrical cable shields enclosed in a BeCu wrap-around band. This joint connection produces an electrical grounding path which provides EMI protection. Assembly of the component parts is accomplished without the aid or use of a tool. A sealing member can be used for environmental protection of the backshell interior parts.

2 Claims, 3 Drawing Sheets
EMI TERMINATING AND GROUNDING STRAIN RELIEF CLAMP ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates to an improved terminating and grounding strain relief clamp assembly, sometimes called a “backshell”, for electrical shielded cables and the like. Prior art such as usage of mechanical band dispersed from a banding tool as the means for joint connection between the “backshell” and terminated electrical cable shields, individual and/or overall, is error-prone, tedious, cumbersome and non-repairable assembly.

In some known application, such as today’s fly-by-wire and/or HIRF configured airplane, an almost absolute minimum amount of EMI presence is critical to the airplane system performance. Simply stated, the electrical cable and/or wire shield grounding shall be continuous and free of contamination. The prior art banding assembly is totally impacted by the assembler disadvantage of not having enough “hands” to locate and position individual and/or overall cable shields while applying the mechanical band and then operating the banding tool. The prior art banding assembly almost consistently produced an unacceptable ground shield terminations such as high resistance, misalignment and improper location of the mechanical band, overlapping cable shield braids, loose mechanical band, etc. Another resultant problem is the susceptibility to environmental contamination. For example, when the cable shield is of nickel plating and the mechanical band is stainless steel and the termination platform on the backshell adapter is cadmium plated, galvanic action amongst different metals produces corrosion. Another problem associated with the prior art banding assembly is the inherent non-repairable shield termination which increases the airline’s cost of ownership.

The present invention also eliminates the need for a tool and the user friendly assembly significantly improves the EMI performance, greatly reduces assembly cost, increases reliability and allows maintainability.

BRIEF SUMMARY OF THE INVENTION

It is an object of the present invention to overcome the aforementioned and other deficiencies and disadvantages of the prior art.

It is another object of the present invention to provide a strain relief adapter female member having a configured inner surface which engages the outer surface of a split compression ring causing a forceful engagement on the compression ring with a backshell adapter male member and the backshell adapter having a slotted termination platform for cable shields.

A further object of the present invention is to utilize a conductive wrap-around band to collect, position, locate cable shields, individual and overall, onto the termination platform of the backshell adapter.

A still further object of the present invention is the coupling of the female and male component member to produce an electrical joint connection caused by the split compression ring closing onto the termination platform.

Yet another object of the invention is to eliminate galvanic action when the assembly has incompatible metals by using a wrap-around band as a barrier between metals.

It is also an object of the invention to provide a terminating and grounding strain relief clamp assembly which is tool free to assemble, reworkable and maintainable. The present invention provides a terminating and grounding strain release clamp assembly or “backshell” that comprises an interfitting metallic shell, housing and coupling parts such as a split compression ring and a metallic wrap-around band which when all joined together form an electrical conductive path with the cable shields to greatly reduce the presence of electromagnetic interference (EMI).

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a reference view to illustrate current art cable and/or wire shields, individual and overall, preparation.

FIG. 2 is an exploded perspective view, made in accordance with the invention, of a terminating and grounding strain release clamp assembly or “backshell” having female and male component members, a split compression ring and wrap-around band and cable shields (as shown in FIG. 1) to be terminated thereto. Also shown is a cold shrinkable sleeve intended for sealing the cable entry area.

FIG. 2A is an end portion view of FIG. 2, showing both individual and overall cable shields fittingly enclosed by a wrap-around band at the termination platform of the male component member.

FIG. 3 is an exploded perspective view illustrating assembly of the terminating and grounding strain release clamp assembly made in accordance with the invention. The cold shrinkable sleeve will provide environmental protection to the assembly.

FIG. 4 is a side elevational view of the assembled backshell, a portion thereof being broken away to show the electrical junction formed by the interfitting metallic shell, housing and coupling parts all joined together with the terminated cable shields, individual and overall.

FIG. 5 is an isometric view of an airplane connector bonding and grounding system illustrating the joint connection or continuity flow from the cable shield to the backshell to the coupled plug and receptacle connectors to the airplane structure.

DETAILED DESCRIPTION OF THE INVENTION

An exemplary embodiment of the invention, sometimes called a “backshell”, is shown in FIG. 2 through FIG. 4. The exemplary backshell comprises a generally backshell adapter 1 female component member, a backshell adapter 2 male component member, and a split compression ring 3 and wrap-around band 4 therebetween. For this description, a cold shrinkable sleeve 19 is used for sealing the cable.
entry area 20 of the strain relief adapter 1. The male component member 2 includes a slotted end 11, termination platform 5 and the female component member 1 having a tapered inner periphery or shoulder 6 intended to engage the outer diameter 7 on the split compression ring 3. A wrap-around band 4 is provided to collect and positionally maintain terminated individual 9 cable shields on the slotted end 11 of the termination platform 5. The overall 10 cable shield is then pushed onto the termination platform 5 on the male component member 2 so that it makes an overlap on the individual 9 cable shields as shown in FIG. 2A. Coupling of the female component member 1 to the male component member 2 will cause shoulder 6 to abut on the split compression ring 3 simultaneously with the forceful engagement 13 on the compression ring 3 and the shoulder surface 15 on the termination platform 5 of the backshell adapter 2 male component member. This tightening 14 on the intermediate members brings the compression ring 3 to close its 70°-75° ends 8 to locked 16 onto the termination platform 5 of the male component member 2 as shown in FIGS. 3 and 4. It can be understood that this embodiment joint connection is now a junction which provides electrical continuity from the cable shields 9, 10 to the backshell. The strain relief adapter 1 female component member is defined by a tapered inner periphery or shoulder 6 behind its internal thread 12. While the two parts are shown axially separated in FIG. 2, the shoulder 6 will act on the outer diameter 7 of the split compression ring 3 upon coupling of the internal thread 12 in the female component member 1 to the external thread 17 in the male component member 2.

The backshell adapter 2 male component member includes a plug housing 19 with external thread 17 and having slotted 11 termination platform 5 for multiple individual shields 9 and overall shield 10 terminations. The slot 11 controls the location, spacing and positioning of each individual shields 9 on the termination platform 5. A BeCu wrap-around band 4 is included, more specifically, inserted around the termination platform 5 to collect and maintain location integrity of the assembled cable shields 9, 10. Also, on assembly where incompatible metals are to be coupled such as but not limited to, nickel plated overall cable shields 10 and tin plated individual shields 9 to the cadmium plated termination platform 5, another piece of the wrap-around band 4 can be used to separate the incompatible metals.

In the use of the split compression ring 3, it is externally formed on the cable 18 of which its configured ends 8 have a 70°-75° taper which comes together when under compression. As described earlier, coupling of the strain relief 1 female adapter to the backshell adapter 2 male member forces the split compression ring to close and envelope 16 the termination platform 5 of the backshell adapter 2. This electrical joint connection is at its level best when the interfitting members are at locations 13 and 14 as shown on FIG. 4.

As will now be apparent, when the female component member 1 and male component member 2 are connected, without the use of a tool, a joint is formed between the cable shields 9, 10 and the backshell. Use of a cold shrinkable sleeving 20 to the assembly provides environmental protection at the cable entry area 21 of the strain relief adapter 1. The present invention provides a terminating and grounding strain release clamp assembly for electrical shielded cable 18 which produces a reliable and maintainable ground connection whose integrity is a result of the user friendly assembly. Another advantage of the invention is the versatility or means to separate incompatible metals which if not eliminated will cause corrosion and degrade the backshell low EMI immunity.

While the invention has been described with respect to a preferred embodiment, reference to application Ser. Nos. 08/986,378 and 09/034,562 for the parts represented by the legends identified in FIG. 5 may be made to show the present significantly improved, highly reliable and consistent airplane grounding and bonding system which is critical to the functional integrity on a "Fly-by-Wire and High Intensity Radio Frequency (HIRF)" configured airplane. For example and as illustrated in FIG. 5, the shielding continuity from the cable or wire shields is carried on to the present invention backshell while application Ser. No. 09/034,562 provides continuation of the described shielding (electrical joint) onto the mixed electrical plug (22) and receptacle (23) connectors and application Ser. No. 08/986,378 closes the shield round loop by extending the electrical joint connection onto the airplane panel and/or structure (24) with the usage of the projecting grounding wave springs 31. To further clarify the electrical joint between the mated electrical plug (22) and receptacle (23) connectors, it is achieved through the grounding fingers (25) mounted on the plug (22) connector. The grounding fingers (25) can be easily damaged mechanically from severe metal-to-metal interference between grounding fingers (25) and receptacle (23) connector metal shell housing and from contamination from aircraft fluids. A new embodiment to ensure reliable joint connection between plug (22) and receptacle (23) is the addition of grounding fingers (26) in a shape of a wave spring on the receptacle (23) connector. These wave spring grounding fingers (26) are mounted or located behind the prior art interfacial sealing O-ring (27) in the receptacle connector therefore eliminating the damage problem discussed on prior art grounding fingers (25). It can be understood that the wave spring grounding fingers (26) are depressed or pushed back by plug (22) and shell face (32) when plug (22) and receptacle (23) are in a mated condition.

Furthermore, various modifications and improvements may be made to the present embodiments without departing from the scope of the invention. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrative embodiments, but only by the scope of the appended claims.

I claim:

1. An EMI terminating and grounding strain release clamp assembly comprising in combination:
   - a cable shields;
   - a backshell female member;
   - a backshell male member;
   - a split compression ring;
   - a wrap-around band;
   - said cable shields are terminated onto said backshell male member, and when said backshell female member is threadedly coupled to said backshell male member the intermediate conductive members comprising said split compression ring and said wrap-around band engages provide a compression type arrangement with said cable shields thereby producing an electrical ground path on said EMA terminating and grounding strain release clamp assembly.

2. An EMI terminating and grounding strain release clamp assembly according to claim 1 for providing a close-loop circuit ground system when said EMI terminating and grounding strain release clamp assembly is mounted onto the aircraft panel and/or structure.